DY 58: Posters - Networks

Time: Thursday 17:00–19:30 Location: P1A

DY 58.1 Thu 17:00 P1A

Modelling the regulation of p21 by p53 after DNA damage — •Isabella-Hilda Bodea and Barbara Drossel — TU Darmstadt, Germany

Biological cells must constantly respond to different forms of stress. One of the most common sources of cellular stress is ionizing radiation, which causes DNA double strand breaks and hence threatens the successful division or even the survival of the irradiated cell. For this reason, cells react to DNA damages by upregulating the tumor suppressor protein p53, which shows multiple pulses after the occurrence of the damage and activates numerous target proteins. One of the most important target proteins of p53 is CDKN1A (also known as p21), a potent cyclin-dependent kinase inhibitor that regulates cell-cycle arrest after DNA damage. Studies of the CDKN1A dynamics post-DNA damage in single cells revealed heterogeneity in the timing and rate of CDKN1A induction and showed that the cell-cycle stage plays a crucial role in this context.

We present a minimalistic nonlinear ordinary differential equation model for the regulation of p21 by p53 that reproduces the overall dynamical behavior of p21 in response to the p53 oscillations following DNA damage. The model includes cell-cycle dependence of degradation rates and several inhibition mechanisms and reveals the possible ways in which the observed heterogeneous response of p21 can arise.

DY 58.2 Thu 17:00 P1A

Estimating outage probabilities of electricity grids under wind power injection — •Christoph Schiel, Pedro Lind, and Philipp Maass — Universität Osnabrück, Fachbereich Physik, Barbarastraße 7, 49076 Osnabrück, Germany

Increasing share of generated power by renewable energy sources in power grids, largely wind and photovoltaic, leads to the question how the stochastic nature of these sources and their corresponding fluctuating power production affects the grid stability. We investigate the probability of failures in electricity grid under wind power injection in dependence on the envisaged mean injected power, a critical power threshold for failure, and a time scale of human intervention to prevent outages. The wind power fed into the grid is estimated from empirical data for wind velocities measured at a wind turbine in the North Sea. Based on a statistical analysis of these data, we suggest a simple formula for estimating outage probabilities. To illustrate our findings, we apply the method to the problem of single transmission line outages in an IEEE test grid, where we replace conventional by wind power generators. Correlations of the obtained transmission line outages to the topological features of the injection nodes are discussed.

DY 58.3 Thu 17:00 P1A

Biologically implementable cycles in a Boolean model of gene regulation — •David F. Klosik and Stefan Bornholdt — Institut für Theoretische Physik, Universität Bremen

Gene regulatory networks have to be implemented in an inherently noisy environment, yet have to perform their regulatory tasks in a very reliable fashion. The main dynamical features of a number of biological regulatory networks (e.g., the cell-cycle sequence in yeast) seem to be well captured in terms of Boolean (threshold) networks with a parallel update scheme. Assuming that the sequence or the underlying network are unknown, we here approach the question of which pairs of cycles and graphs yield reliable results under noisy signal transmission in an autonomous Boolean network model with underlying continuous dynamics, that has previously been applied to simulating biochemical stochasticity in regulatory networks [1].

[1] S. Braunewell and S. Bornholdt, Superstability of the yeast cell-cycle dynamics: Ensuring causality in the presence of biochemical stochasticity, J. Theor. Biol. 245 (2007) 638-643.

DY 58.4 Thu 17:00 P1A

Asymptotic spectrum of multi frequency states in sparse oscillator networks — •Anton Plietzsch — Potsdam-Institut für Klimafolgenforschung — Humboldt-Universität zu Berlin

I discuss various new analytic and numerical results on the structure of asymptotic multi frequency states in sparse oscillator networks.